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ABSTRACT

Three papers presented to The Task Force on Education and Economic Development of The National Conference of Lieutenant Governors are as follows: "Education and American Resurgence" (Frank Newman); "State Economic Development and Education: A Framework for Policy Development" (Mark S. Tucker); and "State Policy on Partnerships Between Higher Education and Industry" (Ann M. Spruill). A foreword by Peter P. Smith, Lieutenant Governor of Vermont, discusses these papers and looks at the importance of education and economic development as state issues. The two general expectations emerging from discussions on education and the economy are the need to be more flexible and the inevitability of change as a way of life in the present economy. Each state faces different demographic, political, and economic pressures, and the task is to provide the right format for viewing the questions of education and the economy. Several general themes include the following: flexibility and partnership; sharing and using the benefits of existing high technology in existing industries; and the role of government as a partner and enabler rather than regulator or sole service provider in the overall effort. Contains six references. (SM)

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LIVING ON THE LEADING EDGE

State Policy Issues for Education and Economic Development in a Global Economy

PS-86-2

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LIVING ON THE LEADING EDGE

State Policy Issues for Education and Economic Development in a Global Economy

PS-86-2

Foreword by Peter P. Smith, Lieutenant Governor of Vermont
Contributors: Frank Newman, Marc S. Tucker and Ann M. Spruill

Education Commission of the States
1860 Lincoln Street, Suite 300
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June 1986

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FOREWORD

No two state issues carry as much combined weight or importance in America today as education and economic development. Although our nation finds itself in a global struggle with other countries to the East as well as the West, the major effort to succeed or fail has fallen to the individual states. Some political leaders have chosen to see the challenge primarily as economic with the rewards going to those who can win a seemingly unending competition for new business.

But others are reaching farther, trying to understand the unique demographic and economic forces which are buffeting our country and our states as well as the world. In Vermont, for instance, all of the major industries — agriculture, tourism, quarrying, machine tooling, and high technology manufacturing — face enormous national as well as international pressure. They know that efficiency, high productivity, excellent training, and a work force educated for a life of learning are all fundamental elements in a business mix which will hold what they have and expand their economic base over time.

Two general expectations emerge in discussions on education and the economy: the need to be flexible and the inevitability of change as a way of life in our economy, or educational systems, and our personal lives. It is not simply that we must do a better job of educating our children and adults, we must do a <u>different</u> kind of a job as we prepare for a future in a global, information - rich economy where social, economic, and cultural change are the constant.

As we try to predict the needs of the future, we touch on a number of powerful and controversial ideas.

- As third world nations compete successfully for low-wage manufacturing jobs, the United States will rely more heavily on knowledge-based industries and manufacturing, knowledge creation, and related service industries. New kinds of jobs requiring higher skill levels will constantly be developed.

- People who historically have not done well in our schools - women and minorities - will comprise an increasing percentage of our school-going population. If these people do not become more successful, we are sowing the seeds of a two-tiered economy with an imported work force, something we cannot afford either financially or socially.

- Education for work is a lifelong enterprise. Gone are the days when a person is prepared, like a menu item, for the world of work.

- Job change, retraining, and flexibility on the part of the individual as well as the employer and the society will become the norm for success, not the exception.

- Excellence and achievement in a pluralistic society must ultimately be measured and recognized in ways which respect the diversity in the population and the individual differences among people.

In short, we face a time when our economic viability as states within a nation will be tested severely. We will prosper — developing jobs for our citizens — only if we understand the absolute interdependence of our marketplace and our classrooms.

Each state is different, facing different demographic, political, and economic pressures. Hence the task is to provide the right set of glasses through which one can view the questions of education and the economy and to pose the right questions leaving the assessment and formulation of answers to leaders in each jurisdiction. Only then can each state understand its special strengths and weaknesses, knitting together a package that will meet its unique needs.

The three papers which follow were presented to The Task Force on Education and Economic Development of The National Conference of Lieutenant Governors in August 1985.

The first paper is drawn from an address by Frank Newman, President of the Education Commission of the States (ECS). He summarizes key points from his recent Carnegie Foundation report, Higher Education and the American Resurgence.

In the second paper, Marc Tucker of the Carnegie Forum on Education and the Economy calls the reader to a different reading of the value of high technology manufacturing in a state policy framework. He urges a focus which sees its importance not in the percentage of the Gross State Product or employment that it provides. Instead Tucker argues that the challenge lies in assuring that existing industries — from legal services to glass-making, from insurance to automobiles — receive the benefit of main line technology tools and materials in order to compete effectively in a changed economy. From that beginning point, he develops a different view of appropriate educational support than the current orthodoxy about either classroom education or job training.

The final paper, by Ann Spruill of the Falcon Investments, Ltd., Boston and Economic Consultant to ECS, proposes a policy framework for higher education — business partnerships in the states. Her basic warning, however, is to remember that "there are no easy answers"; that the high technology approach of today could well be the smokestack industry of tomorrow in your state. She argues persuasively for the characteristics of flexibility and innovation in state planning to reach the goal of sustained growth and stability. In each of the five forms for state policy development which she proposes, Dr. Spruill suggests that partnerships, not individual action are the most productive medium to use.

There are several general themes which run throughout this report: flexibility and partnership; sharing and using the benefits of existing high technology in existing industries; and the role of government as partner and enabler, rather than regulator or sole service provider in the overall effort. States need the right questions and a consistent process for planning in this period of dynamic and continual change. These papers can enrich the discussion and assist in shaping state policies that will ensure the continued economic and educational health of our states and their people.

Peter P. Smith
Lieutenant
Governor
of Vermont

EDUCATION AND AMERICAN RESURGENCE

by
Frank Newman
Education Commission of the States

It is no secret that this nation is in the midst of a profound economic transformation. Two elements of this transformation make it different from previous economic changes.

The first is the scope, complexity and speed with which the transformation is taking place. Not only are new technologies buffeting us with more information and more opportunity than we can absorb, but the demand for new ways of organizing to meet the competition from aboard is threatening to eliminate — or to transform — some of our basic bread-and-butter industries. Traditional jobs are being replaced by jobs that demand new concepts, new skills and new kinds of education.

The second difference from previous economic changes is the emergence of stronger and broader state leadership as the nation seeks to meet its changing economic needs. From World War II until now, reshaping and energizing the nation's economy has been a responsibility assumed by the federal government. During this debate - the economic equivalent of Sputnik - the federal government has been less willing to be involved. The states, recognizing their own urgent need for economic development, have taken the leadership role. In part, this reflects their awareness that the health of our economy — and ultimately the health of the world economy — is inextricably linked to how well our education system performs. And education is a state responsibility.

The federal government has traditionally played a role in linking higher education and economic development . Over a century ago, the federal Land Grant Act of 1982 linked the establishment of what have become some of our great research universities to the emerging agricultural science and industrial growth of that time. This act recognized the intimate connection between university research and the applications of technology, and, as well, reflected a conscious decision to enter the race for worldwide economic leadership.

By the end of World War II, which drove home the danger of lagging behind in research, the nation's scientists pressed for, and got, additional federal commitment. Agencies such as the Office of Naval Research, the Atomic Energy Commission, the National Science Foundation and the National Institutes for Health began federal support through competitive grants for university research. The results have been spectacular. New research universities have been established. Federal support for these efforts has grown from a few million dollars in 1950 to $4 billion in 1980. In addition to the universities, the government established its own laboratories. Today, 700 federal research laboratories house over $25 billion in tools and instruments, and employ over 206,000 people. It is the universities, however, that supply the cutting edge for research in almost all fields. One result has been that American universities wrested the leadership in research from Europeans in virtually every field.

Recently, my colleagues and I prepared the report, Higher Education and the American Resurgence, which attempted to measure where the most advanced research is going on. It is clear that we are still doing well in research - the United States remains ahead of the world in almost all areas of basic research. Then we attempted to evaluate our standing in applied research or technology. The third leg of the triumvirate, the development of new products from that technology, we did not evaluate. In the U.S., this task is primarily the responsibility of industry, not higher education.

In applied research or technology the United States still leads the world but the competition has overtaken us in many fields. Today, therefore, concern is focused on how to improve the effectiveness of the use of research; that is to say, how to translate research into technology. As a result, states and universities are beginning to address the need for even stronger linkages between research laboratories and business and industry. Our research leadership is responsible not only for our economic development but for the advances in health care here and in most of the world's nations.

International competition has made us realize that economic growth is more dependent on applied technology than we had realized. Our leadership gap continues to narrow. In such specialized areas as the physics of surfaces and interfaces and fluid mechanics, the United Kingdom and the Soviet Union have advanced. We are behind the European Consortium for Nuclear Research in high-energy physics, and behind Germany and France in some aspects of solid-state chemistry.

The Japanese have been by far the greatest threat to us in the area of applied technology — translating research into technology (as well as the greatest threat in product development). Right now, the struggle for technological leadership is focused on such fields as advanced ceramics, large-scale integrated circuits, supercomputing, artificial intelligence, optical fibers, machine-tool technology, video recording, robotics and computer-assisted design.

To meet this competition, the United States must make changes, including changes in higher education. Our research universities have centered their attention on basic research. There has been less interest in, prestige associated with, and reward for translating that research into technology. To regain the lead, to maintain our own economic development, and to stay in the world race for economic leadership, it is obvious that we need to find better ways to accelerate technology development and to insure that universities provide the opportunity for industry to take the maximum advantage of the new technologies. This requires change in the universities so that they are not simply research universities but both research and technology universities. It also requires changes to improve how we link business and industry with the research community, so that both can work together toward a common purpose.

The states have already recognized this need. In their smaller, diverse universes they have seen that their economic health depends on a solid tax base, opportunities for new and changing businesses, and jobs for their citizens. Many states are engaged in a technological race with their neighbors. They have developed programs, publicity and legislative incentives to attract high-tech industry. We all know about North Carolina's Research Triangle, California's Silicon Valley, Massachusetts' Route 128.

New kinds of industry/university cooperation are emerging; pockets of cooperative ventures can be found across the nation. Human capital programs are aiming at educating young people for specific jobs in specific industries. Research development and technology programs bring more research into surrounding industry with "technology incubators" or technology centers. State programs offer training and financial assistance to potential entrepreneurs, often with the help of the university's business school. State information centers link research being conducted at state universities to industrial users.

Perhaps because federal support for education is waning in the 80s — or maybe in spite of that fact — the states know how important education is to economic development. They are beginning to act on their concern. The ECS Task Force on Education for Economic Growth, chaired by former North Carolina Governor Jim Hunt,

for example, brought the issues and the state perspectives into focus. Nearly every state has acted to reform elementary/secondary education and to make it more responsive to the accelerating demands of the marketplace and the needs of the nation for a better educated work force.

I'm going to suggest here that the high-tech race is a distraction for the United States. The real issues encompass high-tech, but they are broader and deeper. Despite claims by some futurists that our industrial age is ending, it is not. We cannot afford to abandon our smokestacks for computer terminals. What we can do, should do and in some cases are doing, is blend the two. We need to apply some of our technology to our smokestack industries, being them up to date, instill in them a creative, entrepreneurial mode that will keep them flexible enough to move and change as fast as technology itself is evolving.

We worried when U.S. Steel and General Motors were in trouble. We need to worry because Apple Computer is in trouble. Did they get trapped on their own technological plateau? Did they run out of creativity? Succumb to organizational stasis? Fail to see their next opportunity?

At issue here is not a technological revolution, but a new way of thinking, a new way of responding to challenges that is far-sighted, creative, flexible, adventurous and risk-taking. We can pick up this challenge and move ahead with our economic development and our world leadership, or we can shrug our shoulders, and like Great Britain, give up the lead to a stronger, more ambitious, more energetic nation.

The outcomes of this world race are not preordained. What happens to the United States, and to the 50 states themselves, will be a result of conscious decisions by national and state leaders. We can, like those in the San Francisco peninsula, set the stage for vitality with a progressive, risk-taking climate, or we can settle, like some of the cities of the midwest, into the dust for shaky, obsolescent industrial decay. It's all a matter of will. And education at all levels will have to play a major role, for we will need new kinds of leaders who have been prepared to lead in new ways.

The American role of leadership in the world places broad demands on higher education. We must produce economic, scientific and technological leadership, to be sure. But much more is involved. We need leaders who will spark cooperative efforts at home and aboard; who are willing to face difficult social and political problems; and who are determined to work toward constructive solutions. In effect, we need a true American resurgence.

As good as American higher education has been, it is going to have to get better. It is not only going to have to get better, it is going to have to be different, to produce graduates who have the expertise the nation needs; to extend its basic research and technological capacity; to equip and empower its graduates with creative thinking skills and to instill in them an enthusiasm for risk-taking that has not been evident before.

Changes in emphasis will be needed at all levels, including professional schools. One major change involves treating our students to a renewed international perspective. We haven't done this very well in the past, and the issue has been emphasized in reform reports. We all know that not enough of our students have been learning foreign languages, and that this has hurt us on the world economic scene. Perhaps less well understood is our need for citizens — and leaders — who understand the perceptions of different people. We need to understand that other people see issues differently, conduct business by different rules, see us differently than we see ourselves, and are not ignorant

or stupid for doing so. This understanding is basic to our world leadership and we ought to be vigorously promoting it, perhaps by creating more opportunities for our students to live and study abroad. This last fall, over 340,000 higher education students from abroad studied in the U.S. Only 25,000 Americans studied abroad.

Overarching higher education's challenge to change is the call for sheer, overall quality. Among others, New Jersey Governor Tom Kean (ECS chair for 1985-86) is responding to this call with some very direct actions. He initiated an ECS task force for improving the quality of undergraduate education, and charged it with "gathering facts about the extent of the need for improvement, examining the growing pool of successful state practices that can stimulate the support institutional leadership," and finding "ways to ensure that the broader public purposes that transcend any single campus are fulfilled." This is no small task, but it is one that, I am sure, is not beyond the capacity of the 20 leaders selected to serve on this group. A major policy report from this project will be released at the ECS annual meeting in July 1986.

Current efforts to beef up the quality of elementary/secondary education, while laudable and timely, will not fill the nation's total need for an educated, committed citizenry who can actively participate in its economic growth. Nor will these efforts direct enough of the right kinds of potential leaders into the nation's higher education for the kind of training, education and orientation they will need to truly lead. State actions to raise standards and toughen course requirements have not yet addressed the concern for the problems of our "at-risk" youth. This population group, a mix of disadvantaged, disconnected, unmotivated, turned-off young people — too many of them minorities — will be needed to secure the nation's future. Business and industry will have to draw employees from this group. Political and cultural leadership will have to come from this group. And unless the reform movement expands to accommodate these at-risk young people, they will not be prepared to participate in an American resurgence, much to our nation's loss.

My point is this: Tougher standards are good. But we will need to find ways to help our at-risk youth meet them; quite obviously they have not met lower standards by themselves. Here again, we must consciously choose to include this potentially valuable group in our renewal efforts. Tough standards are not enough; more effective education is essential.

The ECS Business Advisory Commission — a group of business, education, labor and political leaders — targeted at-risk youth for special attention. In their report, Reconnecting Youth: The Next Stage of Reform, these leaders defined the problem, identified model programs, and challenged their colleagues. Cooperation between business and education will do a lot to solve the problem, they believe.

If we don't do more to bring our disconnected youth back into the mainstream, they will drop into already-troubling — and unproductive — population groups that need our help as well: adult illiterates, the chronically unemployed, and workers whose job skills no longer match the needs of business and industry.

Several times, I've mentioned the need to make conscious decisions — decisions that will have to be made if we are to move this nation into a vital resurgence. Certainly, the federal government should continue — and expand — its role in broad fiscal, monetary and trade policy, in policies to encourage and support university research efforts, and in policies that ensure that the nation's young people have the right kind of opportunities to get an education and to develop their potential as leaders. It is the states, however, that have the constitutional responsibility for education and it is the

states that must develop policies that encourage, enable, support and monitor a resurgence in American education. State policy makers, as they consider the needs of their states and the nation in the context of the international scene, will need to address questions like these:

1. How can states encourage and support our research universities as they gear up to meet state and national demands? Can we find ways to bring our universities into closer, more cooperative relationships with business and industry, to the benefit of both?

2. Should states re-examine, along with the federal government, our policies that shape the research agendas of research universities and government research laboratories? Historically, our research agendas have been more unstructured than focused, although some of our research centers have operated on distinct, well-identified missions. Does our system for funding research still work well for us? We have relied, essentially, on competitive grants rather than research mandates.

3. Are there other, better, more creative ways to move this nation more quickly into applied technology?

4. What can we learn from existing examples of business/higher education cooperation? Are there approaches that will work well in some states but not in others?

5. Are states willing to allocate funds to human capital development, entrepreneurships, clearinghouses for research information?

6. Have we a clear vision of just what we want students to have as a college education in the future? Do we really know what quality is? What measures should we use to tell if things are working?

7. Are we willing to create and support national, state or local programs that work to bring at-risk youth back into society? What kinds of programs do we need? Which ones work best?

8. For the short term, can we develop or expand programs to help already troubled adult workers back into the market place, so that they can "hold the fort" until our "new crop" of young citizens is ready?

9. Are there ways that states can help universities produce better citizens and more creative, risk-taking? Are service programs — in exchange for education support — an answer to consider?

10. How can we create a public climate of enthusiastic support for our American resurgence? How can we encourage our citizens, to care and to act? How can we create a climate that encourages all of our organizations, and particularly our colleges and universities, to re-examine and improve every aspect on their operations.

STATE ECONOMIC DEVELOPMENT AND EDUCATION:
A FRAMEWORK FOR POLICY DEVELOPMENT

by
Marc Tucker
Carnegie Forum on Education and The Economy

Over the last few years, state government leaders have increasingly acted on the perception that their state's economic future is linked to its education policies. In many states, this perception has led to a common formula:

- o beef up salaries at the leading engineering school;
- o build a high-tech research center with close industry ties to the leading research university or a consortium of research universities;
- o make that center the cornerstone of a research park that will attract private firms engaged in high-tech enterprise;
- o establish a mechanism for improving communication of research results produced by state universities to private entrepreneurs;
- o improve coordination between state agencies responsible for jobs programs and those responsible for vocational education; and
- o offer free or low cost vocational training to firms willing to locate new plants in the state or expand existing facilities.

Add the usual attempts to offer competitive tax rates and financing incentives, and you have the standard economic development package updated to include the new education components.

In many states, of course, government leaders have gone beyond these specific measures to invest considerable energy in policy initiatives designed to improve the quality of elementary and secondary education across the board, explicitly on the grounds that doing so would strengthen the state's economy. This is particularly true of many southern and border states that realized they could no longer rely for economic growth on the attraction of low wages and weak, or non-existent, unions; they cannot compete on these grounds with developing countries. And it was also true of the oil-rich states, which can no longer rely on oil revenues to keep taxes down and meet employment needs.

Many of these policy initiatives were the result of considerable vision and were enacted into law or otherwise brought into being only after the exercise of outstanding political leadership. They brought many benefits to their states; in the south, the scene of the greatest activity, these measures made a particularly important difference for blacks, whose prospects were greatly improved as a result. But these policies are likely to prove to be only the beginning of what is necessary.

At the risk of caricaturing the policies just described, it might be said that they rest, in part, on the following premises:

- o economic growth depends mainly on attracting high-tech industry (defined mainly as computers, semiconductors, telecommunications, ceramics, composites and biotechnology),

- high-tech firms will be attracted mainly by strong engineering education programs, access to strong university-based research programs in high-tech fields, attractive financing packages, favorable tax rates and good schools for employee's children, and

- free custom-designed training for blue collar workers will frequently be the decisive factor in attracting manufacturing plants to a state.

The policies of particular states and regions of the country seem to have reflected some of these premises more strongly than others at any given point in time, but, taken as a set, they appear to underlie the broad development of policy throughout the country. Plausible as these premises may sound, however, consider another set:

- economic growth depends mainly on integrating the use of advanced technologies into existing manufacturing and service industries in the state, turning many old line industries into high-tech industries;

- turning many of the existing industries into high-tech industries will produce a need, across the board, for a labor force with much higher skill levels than at present, and very different kinds of skills; and

- the need for narrowly trained people who have low academic skills will sharply decline — they will be unemployable in increasing numbers.

This second set of premises leads to very different policies than the first. The case for the second set is increasingly compelling. Consider the following.

No serious economic forecaster has suggested that a large segment of the country's jobs will be accounted for by direct employment in the high-tech industries listed above. The Apple Computer Company employs less than 6,000 people worldwide. A year ago, Apple set out to double production volume of the Macintosh computer without adding a single staff member, a perfectly plausible goal.

The importance of these industries does not lie in the proportion of GNP or employment they will represent. What is important about these industries is that they will supply the tools and materials that all the other industries — from legal services to glass making, from insurance to automobiles — will need in order to compete effectively in the years ahead.

Putting the same proposition another way, no state will prosper from the handful of high-tech jobs imported with much fanfare into the state, if tens of thousands of jobs are lost to that same state because the businesses that produce those jobs fail to compete effectively in a changed economic environment.

The process we are going through now in industry is similar in many respects to what happened earlier in agriculture, though not in the way most people think. It is said that agriculture now employs less than three percent of the work force, and it will not be long before manufacturing employs a similar fraction of the work force. The future, it is said, lies in services. These statements are simplistic at best, dangerous misconceptions at worst.

The food production and food processing industries account for close to a quarter of the employment in this country. If this nation were to import all its food, those who would lose their jobs include petroleum engineers in New Jersey who produce fuel for

farm tractors, chemists and process engineers in Delaware who manufacture fertilizers, commodity traders in Chicago, tractor designers in Wisconsin, economists employed by grain merchants in Minnesota, agricultural epidemiologists in California, geneticists in Maryland and international bankers in New York. All these people wear white collars. Almost all have a college education; many, in fact, are graduates of professional schools and have advanced degrees. Even the managers of those few farms that produce most of our agricultural output have four year college degrees and many have advanced degrees.

The point is that our phenomenally efficient agricultural production system employs a large fraction of our work force, all of whom are directly involved in activities that are integral to agricultural production and food processing, but few of whom work on the farm. Rising efficiency in agricultural production has meant an enormous shift from reliance on unskilled and semi-skilled manual labor to increasing dependence on cognitive labor, on people who think for a living. This country's ability to generate the largest agricultural surplus in the world is intimately connected to a very dramatic rise in the education level of the people involved.

Much the same thing is now going on in manufacturing. The basic industries and mass production of highly standardized items powered this country to world economic leadership in the closing years of the last century and the first part of this one. Industrial production was organized around a labor force composed of people doing mostly manual labor, people who needed only the "basic skills" and a modicum of training. These unskilled and semi-skilled workers were able to make very high wages, relative to the rest of the world and to average manufacturing wages in this country, until foreign competitors started to manufacture and export the same products at comparable quality levels and lower cost.

Many countries with very low wage rates now have highly disciplined labor forces with the literacy levels required to work on the shop floors of conventional industrial manufacturing and assembly plants. The United States can no longer compete effectively in industries that rely on a labor force largely composed of unskilled or semi-skilled people. Because seventy percent of the domestic economy is open to foreign markets that are closed to us, but that we can not compete in our own domestic market if our product incorporates a significant amount of low skill labor.

Manufacturers have several choices. If they wish to continue manufacturing products using significant amounts of relatively unskilled labor, they can search for low wage rate countries in which to locate their plants. If they are very large companies that mostly assemble parts made by others to their specification, they can shift from domestic part suppliers to low cost foreign suppliers. Both of these routes have drawbacks, including long turn-around times for getting new production lines up to speed, rising wage rates in third world countries, problems of political instability and quality control problems.

But to stay in business and keep producing in this country, a firm must overcome foreign competitors' labor cost advantages. This cannot be done simply by using modern production machinery, because there is nothing to prevent low labor cost competitors from doing the same thing. The most modern steel plant in the world, for example, is located in South Korea. Staying competitive can only be done by engaging in production involving mainly high skill labor, a scarce resource on the world scene. Employers can afford to pay well educated employees with high skill levels well because of the value they add to the product or service. Thus the answer to the dilemma is not automation, per se, but the creation of enterprises that make sufficient and appropriate use of people who bring a very different set of skills to the job than do most of the world's workers.

What would characterize such enterprises? Some will compete effectively because they offer products of unique value that can not be obtained elsewhere — an automobile based on the use of composites for its body, making it very durable and fuel efficient, and on a ceramic engine that will last hundreds of thousands of miles, needs no antifreeze and burns fuel so efficiently that there is no need for pollution control devices. The first producers of such cars will have an enormous advantage in the world market. People will be willing to pay very high prices for such cars because of the long period over which they will be able to amortize the purchase price and the low operating costs.

Or, we might be speaking of a medium sized construction firm that lowers its costs dramatically by combining advanced computer-based project management techniques and job-costing techniques with automated prefabrication and construction methods; a small legal firm that uses computer and telecommunications systems to search precedents efficiently, locate relevant expert witnesses quickly and scan mountains of documents to assemble compelling arguments; a glass factory that automates the manufacturing process and positions itself to turn out small lots of special purpose glass for ornamental architectural work; or an insurance company that acquires a reputation for being first to sense new markets and new requirements in old markets, keeping its costs down through inventive methods of computer-based risk estimation and claims processing.

These firms will be looking for ceramics engineers; manufacturing engineers who can find low-cost methods of manufacturing composite materials on a large scale; consultants who can assemble flexible-manufacturing plants for the construction and glass industries; legal assistants who are very adept at using sophisticated information technology to conduct legal research; factory foremen who know how to do changeover operations in flexible manufacturing plants quickly and efficiently; builders who are familiar with sophisticated computer-based project planning techniques; or very creative artists who work in glass and are at home with computer-aided design and manufacturing systems.

The blue collar and pink collar jobs will slowly decline as these sorts of jobs multiply, giving way to "grey collar" and white collar jobs, especially in those states whose economy prospers. Manufacturing and service industries will follow the same route as agricultural production and food processing. We simply cannot afford to pay unskilled and semi-skilled labor the wages they have been paid in the past if we are to survive in a fiercely competitive international economy, any more than the farmers of the past could afford to pay manual workers on the farm wage rates comparable to those of the new industrial workers. The farmers had to become more efficient. Agriculture became largely head work. Those manufacturing and service industries that survive and prosper will likewise become mainly head work — head work of a particular sort, though — involving high skill levels rather than low, and broad skills rather than narrow.

The prevalent image of a high-tech society is dominated by images of data entry operators mindlessly keying data into central computers from filled-in paper forms, their key strokes counted by the machine — a modern sweat shop.

This image is real enough, but is rapidly becoming outdated. It was characteristic of a time in which data processing was done in a central location on a very large time-shared main frame computer accessed by dumb terminals located near the computer. With the advent of distributed computing, intelligent terminals and networked digital communications, the days of the data entry operators are actually numbered, and their

place is being taken by the customer, who is being provided the equipment required to enter the data free-of-charge to the service provider.

In the beginning was the automated teller machine provided by the financial institution. Then came the automated filling stations in California, in which the customer inserts a card with a magnetic stripe into the pump, fills the gas tank, removes the card and drives off, all without the benefit of local human assistance, since the card automatically transfers the necessary funds from the customer's account to the oil company's account without human intervention.

The same technique can be used to facilitate purchase of items of all sorts at home or at a demonstration center at the local shopping mall. See a full color moving display of the item on the screen in your home or a sample of the real merchandise at the mall, insert your card into the machine, then punch the code of the item you want, and it is sent directly from the supplier to you the next day. Your bank account automatically debited and the supplier's account is credited for the right amount. Or maybe you are going out to dinner, and, when done, you hand the cashier a "smart card", a card with a computer chip which you load up with "money" at the bank and which is debited by the cashier at the restaurant.

What is being described here has been called the "self-service economy" by some, a set of developments made possible by modern information processing technology that have the potential to eliminate millions of low skill jobs, including retail clerks, stockhandlers, cashiers, people who process check and credit transactions and countless other jobs requiring very little skill.

The jobs that will replace the cashiers, stockhandlers, clerks, assembly line workers, and welders will be the ones described earlier — the automated glass factory designers, computer-competent legal assistants, builders with sophisticated project management skills, creative marketing people in efficient insurance companies, foremen in plants using flexible manufacturing equipment, designers of automated shipping platforms, manufacturing engineers who can work the bugs out of new manufacturing processes, and so on.

Not only will the available jobs require much higher skill levels, but they will require the ability to learn new skills quickly. This is partly because of the nature of competitive advantage in the transformed international economy. As soon as new industrial processes become known and subject to routinization, mass production facilities can be designed to take maximum advantage of low cost labor. At this point, the relative advantage shifts from the innovator, who depends mainly on high skill, high-wage labor, to the mass producer, who depends mainly on low skill, low-wage labor. Or the process can be completely automated.

In either case, however, contemporary experience suggests that product lives are getting shorter and shorter, and the most profitable firms in high wage countries are likely to be those that are the most nimble, the first to take advantage of new developments to create new markets and better meet the needs of established markets.

Thus the United States will find itself in a position in which it must always be on the leading edge, creating new markets, inventing new materials and energy sources, designing new products, coming up with new manufacturing processes, creating new services — constantly inventing, designing, creating.

If this analysis is correct, there are many implications for state policy. The first

has already been grasped by the southern states: the day is over when states can successfully compete on the basis of low wage rates and relative freedom from the need to deal with strong unions. Firms who find these advantages decisive will go offshore. They passed through the south as transients.

Free training for relocating firms will probably also prove to be an ephemeral advantage, if it is not accompanied by a major restructuring of the state's education programs. Free short-term training fits very well with a package based on low wage rates, low taxes and weak unions, because it completes the package of features that are attractive to firms whose product is based on significant use of low-skill labor. But, if this country is increasingly unattractive to such firms for the reasons suggested earlier, free training is not likely to offset the disadvantages. This is particularly true inasmuch as other countries with wages lower than ours, such as Ireland, are also offering free training.

Nor is fierce competition for high-tech firms likely to pay off, because, as was noted earlier, there are not enough of them to generate enough employment in enough places to make the needed difference.

No, the more mundane but much more productive strategy is likely to involve leaving no leaf unturned in the effort to help the glass factories, automobile companies, law firms, textile plants, insurance companies and construction firms already in your state incorporate advanced technology into their businesses, becoming thereby more productive and therefore more competitive. The states must become very adept at encouraging the firms within their borders to use the high-technologies effectively.

The effect will be to raise skill requirements dramatically, for all the reasons outlined earlier, and the states best able to meet those requirements with a steady stream of highly skilled workers are likely to have the best economic growth records in the long run.

To be nimble in a leading edge economy will require that a high proportion of the work force have a firm conceptual grasp of a wide range of subjects in the arts and sciences that only a handful can now be said to understand; that people be able to communicate complex material effectively to others; that workers demonstrate a high degree of initiative in an environment where much depends on their being able to work well with one another; and that workers' creative potential is fully developed and used. It is these skills that are becoming truly "basic", in the sense of being essential to gainful employment beyond entry level, dead end jobs.

Reaching goals of this sort will require a transformation in the educational institutions of every state in the union, from kindergarten through graduate and professional school. Many are now headed in the opposite direction.

States that are trying to raise standards of performance in the schools by specifying the behavior of teachers in ever more detail and tightening the screws of accountability without providing teachers with commensurately greater autonomy will drive out of teaching the very people they most need. This is in contrast to states that find ways to offer career teachers the pay, autonomy and working conditions enjoyed by middle management in industry. States that seek to meet employers' emerging skill needs by pumping students with low academic skills full of short-term training will find themselves losing out in the long run to states that acquire a reputation for having a work force with education levels so high that people can learn new roles and tasks often

and easily.

States that think that they only need, at the higher education level, to pay attention to their engineering schools and build research parks will find themselves losing out in the long run to states that invest in the overhaul of their higher education systems. What is needed is for those institutions to raise radically the skill levels of those already in the work force, while at the same time upgrading and changing the nature of the education provided to undergraduates in every subject, to reflect the goals outlined earlier.

A transformation in education is required, to match the transformation in the economy. The advantage will go to states that figure out how to teach math and science subjects now taught to college sophomores and juniors to junior high school students, turn out sixth graders in large numbers who can write well; produce eighteen-year-old builders who have mastered advanced project-planning techniques; train lab technicians who can use sophisticated methods of statistical analysis; and produce factory floor managers who understand the properties of the materials they deal with and the technical basis of operation of the machines used to handle them.

These requirements come at a time when the number of young people are declining as a fraction of the population as a whole, and as an increasing fraction of the number of young people are made up of children from minority and low-income backgrounds - children who have profited least from the education system as it is now organized. It is hard to escape the conclusion that much depends on providing not just retraining, but real education, to many people already in the work force. Much depends on finding ways to produce unprecedented gains in educational achievement for children from minority and low-income backgrounds.

The core of the challenge facing the states is to figure out how to raise greatly the quality of education provided in their educational institutions without incurring a commensurate increase in costs. Meeting this challenge will necessarily involve bold changes in institutional structure, changes that go way beyond anything yet tried in the current phase of educational reform.

STATE POLICY ON PARTNERSHIPS BETWEEN HIGHER EDUCATION AND INDUSTRY

by
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Introduction

To answer questions raised in state houses, town meetings, and the press concerning policies to improve regional economic performance by enhancing university-industry relations, much is being written about the context in which such interactions take place. The federal government and mission agencies, the universities and their faculties, and the business community have all become involved. This paper will examine only state policy. On the basis of that examination and a set of general criteria for useful state actions it will: 1) highlight case studies where state policy options have succeeded, and 2) recommend elements for effective policies.

Overview

The attention of state policy makers has been riveted on the drive to expand their economic base, create stable jobs, and thus ensure the welfare of their constituents. This is not new. What is new is the increased attention to regional planning and to capitalizing on strengths that are unique. The overwhelming weight of inquiry has been on fostering of high technology industries: But, it is changing as the analysis becomes deeper. The high-tech industry of today could be the smokestack industry of tomorrow. What are needed are flexible, innovative plans that recognize the dynamic nature of economic development. Which pieces of one state's plan for success can be copies with impunity by another? Where must the replication end and the new template begin?

Pursuing a policy of trapping specific jobs has questionable value. Flexibility must be paramount. Specific jobs and job skills disappear. Concessions made by the states to businesses may yield only short-term, limited gain. Many bidding wars pit one state against the other in a nationally zero-sum game. Differences among the states are marginal when compared to those between the U.S. and foreign countries. Capturing jobs and industry from the Northeast only to have them lured away to Mexico, Pacific Rim, or Malyasia is a costly mistake. It only temporarily changes the tax base, relocates families and stresses local services. For the nation, and in the long run for individual states, the temporary creation of elusive wealth is not what matters. Economic development in its best sense is the sustained growth and stability that lead to security. Short run fluctuations will occur. Successful policy must be structured for the long run.

While each state is concerned with unemployment, every state feels its impact in a different way. Unemployment rates vary sharply across the fifty states. In the ten most populous states, February 1985 unemployment rates changed from between 3.7 and 9.4 percent. The national average was 7.3 percent. One of the most frequently cited reasons for differences in unemployment rates across states is the industrial mix. Michigan, Oregon, and Pennsylvania have had higher than average unemployment because such large proportions of their labor forces are in industries with high unemployment during recent years.[1] This has been the impetus for the surge in state interest in attracting the "right" industrial mix. Often the solution is to apply the Route 128-Silicon Valley "formula" to the smokestack states. Can this work?

Recent history suggests proceeding with care. For example, in Indiana a significant portion of the electrical and electronics equipment industry supplies the automotive industry. The prosperity of the high technology in the Great Lakes is inextricably linked to that of smokestack manufacturing.[2] There are no simple solutions. The nation's purpose cannot be served by abandoning one sector of the economy to focus on another. The high technology of today is the obsolete generation of tomorrow.

As the U.S. dominance of world manufacturing slipped, attention turned to the models of industrial planning used by our economic competitors. But the number of jobs created in U.S. manufacturing has been greater to that of Western Europe and Japan. A comparison of policy actions reveal that the strength of the U.S. system is in its flexible labor market.[3] One key to this flexibility lies in the U.S. education and training system.

The correct conclusions must be that those state policies that lead to increased labor market and industry flexibility will be more successful. This requires a creative partnership between business and industry. To date, how have states tried to promote these linkages?

The Office of Technology Assessment (OTA) was charged by Congress to examine regional high technology initiatives. The study, begun in 1982, examines the role that high technology industries play in regional economies, and identifies the types of programs state governments have established to encourage high technology development.

Evidence revealed that the states were very active in pursuing development efforts. Paul Phelps, the Program Director at OTA for the project, believes that the states are far better suited to the task than the federal government. The study's strongest conclusion was that innovation and cooperation at the state and local level seemed to be the most critical ingredient for the success of the nation as a whole. Any federal initiatives should be focused on easing the states' burden.

State development can take one of five generic forms. Numbers 1-4 are distinctly the realm of higher education:

1. Human Capital Programs — education training
2. Research Development and Technology Transfer Programs
3. Entrepreneurship Training and Assistance
4. Information Gathering and Dissemination
5. Provision of Financial Capital or Physical Property Rights

OTA initially found 38 of these programs in 22 states. By early 1985 there were over four times as many. The National Governors' Association reports that 39 governors specifically cited economic development as one of their top three priorities in 1984.[4] The methods selected for accomplishing this goal were various combinations of categories 1-5 above.

Which of these plans works best? Th answer is frustratingly hard to decipher. The relatively short life of the programs and the diversity of goals they attempt to meet make the answer to this question an elusive one. Most of the state initiative programs are new, no more than five years old, with some notable exceptions. The primary goal of the majority of the state initiatives is jobs — creating them, expanding them, keeping

them. Some careful analysis of cast studies, state reports and on-site interviews provides insights into the right director for success.

University - Industry Partnerships

The increasing interest in policies dealing with university-industry interactions is not new. The Morrill Act in 1862 established land-grant colleges as a means of improving economic performance in agriculture, commerce, and manufacturing. Even the emphasis on technology has precedent. The first experimental engineering station was established by the University of Illinois in 1903; and the states instigated the most concerted efforts. (There was a drive to get federal support for university-based experimental engineering stations, but it failed in Congress in 1916.) Thirty-eight such facilities had been established at land-grant colleges using university and state funds by 1937.[5]

The direct involvement of university personnel in business activities also has historic precedent. Elihu Thompson, an electrical engineer, ran his own company while he was president of the Massachusetts Institute of Technology in the 19th Century. His firm eventually became General Electric. Kenneth Olsen, founder of Digital Equipment Corporation, also an MIT legency, might be seen as his modern successor.

It is the variety of business and academic collaboration that is unparalled. The American Council on Education directory lists more than 300 higher education-business partnerships. This only begins to estimate the formal interactions, which is dwarfed by the incredible volume and complexity of informal connections. For state policy to be successful, it must be more than just aimed at the right target; it must also select the right instruments. Universities are far fewer in number than industrial firms and far more homogeneous. Therefore, policy to enhance university-industry partnerships should focus on the university rather than industry.

Examples

The most practical approach to building policy is to examine existing programs. What follows is a selection of examples of programs — their goals and results — from around the country.

Human Capital Programs: What will matter most in how the states meet the current demands is how wisely they attend to their resources — particularly their human resources. The dislocation occurring in the American economy is as dramatic as any in our history. It is not simply a case of doing more of what we already knew how to do well. The game and players have changed. Some economists, for example, Michael Piore and Charles Sabel, argue that the familiar age of mass production has passed. Therefore, educating and training as it has existed is no longer sufficient. We are engaged in a world with new competitive pressures, changing production processes and altered demographic trends. To date the long-term challenges outpace the short-term solutions.

The response thus far has been to focus primarily on technical training. The pitfall is to avoid the unnecessary use of public monies for purely private training. A state presence is justified when training is generalized and applicable across firms or industries, or will not be provided by the private sector.

Issues: Skilling vs. Deskilling
Displaced Workers
Demographic Trends

Human capital programs that create employment opportunities for technical graduates of universities are one approach. The state of Georgia, faced with the departure of many of its potentially valuable college- and university-trained young people, created the Advanced Technology Development Center to help stem the exodus. This program provides opportunities for engineers graduating from Georgia institutions to set up their own in-state enterprise or join a company based in Georgia.

Research Development and Technology Transfer Programs: Flourishing industry in Route 128 (Massachusetts), the Silicon Valley (California), and the Research Triangle (North Carolina) is so closely associated with nearby universities that most states moved to accelerate university research in targeted areas. Ancillary to that is the push to move research into surrounding industry. The success of research development and technology programs like these depends on cooperation between the university and business communities.

One form the linkage may take is that of a technology incubator or technology center. These facilities are usually established by the state and partially sponsored by industry. Documented examples include: the microelectronics centers in North Carolina, Minnesota, and Wisconsin; the Industrial Technology Institute at the University of Michigan; the specialized technology centers at seven universities (both public and private) in New York; the Thomas Alva Edison Partnerships in Ohio; and the Ben Franklin Partnerships (Technology Centers) in Pennsylvania.

A more detailed look at the Ben Franklin Partnerships illustrates that form of partnership. To help preserve and create jobs in Pennsylvania, this program links universities and industry in a job-incubator program, rather than a technology-development program. The program helps such traditional industries as coal, steel, and textiles industries, all major employers in the state.

A policy board composed of industry representative, legislators, economic development officers first initiated the program. This board sent out requests for proposals to universities around the state, reviewed the proposals, and set up four geographically distributed centers, thus establishing university-industry partnerships. The centers' objective is to bring industry, academics and labor together to work toward development.

These partnerships are challenge grant programs in which a formula is used to match state monies to industry funds. In 1984, 60 percent of the funding came from the private sector. The money, used only for program support, is spent in three different areas: research and development projects, entrepreneurial development, and education and technology training.

The state did not want to develop new programs in universities, but chose to build upon existing university strengths. Therefore, each center selected up to four types of technology upon which it would focus. (This style is not similar for all states. New York State preselected technologies for emphasis). In only 20 months, the Northeast Tier program (Lehigh University) has involved over 50 schools and 220 companies in the endeavor.

Several noteworthy features characterize the Ben Franklin Centers. They are separate from the state government. The state issues a grant each year and then remains at arms-length. Each center implements its program as it sees fit, and is later judged on its performance. This allows for substantial cooperation among the centers. But, funding is competitive rewarding performance. The centers submit separate

proposals to the state board, and the private sector "votes with its matching funding."

Potential conflicts between short-term job development and the more long-term technological development are addressed by each center. The primary emphasis of three of the centers has been applied research, and this has helped ease potential goal mismatches.

In general, the development of research centers, technology incubators, and science parks is not the perfect panacea. They have a number of documented drawbacks: substantial development time for success (Research Triangle in North Carolina was established over twenty-five years ago; Stanford Industrial Park over thirty); high fixed and variable costs; and high failure rates (estimated to be near 50 percent).[6]

Entrepreneurship Training or Assistance: A state cannot create private sector jobs, but it can create conditions that encourage employers. The purpose of these programs is to help people who have an idea for a new product or service create the company that will market it. This may involve providing financial capital tax relief, and/or management assistance. One method is linked to higher education the establishment of courses in entrepreneurship at state colleges and universities. For example, the Institute of American Enterprise at the University of Texas and the Center for Entrepreneurial Studies and Development at West Virginia University offer undergraduate and graduate courses in management of small businesses.

Information Gathering and Dissemination: In this approach, the state or state agencies act as information brokers. There is long-standing and successful precedent for this — the county agricultural agent. The state of Michigan has compiled a database of industry-related research being conducted at state universities. Rhode Island maintains a listing of the areas of expertise of state faculty.

Departments of commerce and development in all 50 states have programs designed to assistant small business. Now the emphasis is moving toward providing firms with new technologies developed in universities. For example, Iowa, Louisiana, Missouri, New Mexico, and Washington have some form of innovation center designed to help inventors better develop their ideas. Bringing new ideas to the market results in more jobs in the state.

Financial Capital: One of the chief constraints that new, growing, or changing businesses face is the availability of financial capital. Both Route 128 and Silicon Valley are noted for the availability of private venture capital. If the private sector will not, or does not, provide seed money, a state initiative might be appropriate.

Given limited resources, the key question becomes — where should be state monies be spent for the greatest impact on employment?

The issue remains: Who really creates jobs? Professor David Birch, Director of MIT's Program on Neighborhood and Regional Change, argues that small firms, not large ones, create growth. Certainly the Fortune 500 statistics bear this out. But that does not necessarily imply that small companies provide the best jobs. If the state desires to provide its people with long-term, high-paying, low-turnover jobs then start-up, entrepreneurial firms may not be the ideal source.

However, many states do choose to support the growth and expansion of these start-up companies with the infusion of capital. In some cases, this involves setting up seed capital or venture capital funds. It is rather uncommon for the state governments

to invest solely their own money. Usually the state establishes a program of matching incentives to encourage private investment. One method used is to allow the state employee pension fund to invest a portion of its assets in a relatively high-risk venture. Michigan and Pennsylvania have liberated part of their pension funds from the "prudent man" rule. The Massachusetts Technology Development Corporation attributes its success to a "private investment rule" which calls for a 50 percent match from the private sector in those investments selected for funding. The corporation has launched more than 27 companies since 1979; three of these have gone on to issue public stock.

There is a mixed opinion on whether it makes economic sense for the state to enter the venture-capital business. The states must leverage their resources skillfully. It is at best pointless and at worst wasteful to offer state funds when private money is available. The state of New York's Seed Venture Capital Fund does offer a cogent and persuasive argument for states to enter a segment of this market. They observe that larger venture-capital firms do not offer funding to new companies right at the border between basic and applied research. This is the juncture at which these firms, many just tiny labs or small businesses such as those found in the basements of homes, need financial help the most. It is in the interest of the states to fund this group.

Conclusion

It is not enough to have good intentions. The stakes are too high and the challenges too great to have mere boosterism as active state policy. Any analysis of state economic development policy reveals that an effective link between higher education and industry is imperative for success. The federal government, education leaders, and the business community all recognize and are acting on this. It is up to the states to judiciously blend these interests with their own visions of the future.

There are the added problems for the higher education sector: freedom of information and academic freedom. These freedoms, coupled with the questions of patents and licensure, project accountability, etc., produce conflicts between the demands of the business sector, the goals of the states, and the rights of higher education. None of them is insurmountable, and there are informed models as to how to deal with all of them.

Recommendations

The following recommendations are directed to state policy makers:

- Focus on the university rather than industry.

  Universities are far fewer than industrial firms and far more homogeneous. They are heavily supported by public funds, and are more likely to respond to policy action.

- Focus on universities, industries, and companies not already involved in joint ventures.

  The states have limited resources to expend. Those participants already involved in interactions will continue to broaden their activities naturally. New or reluctant participants must be sought.

- Choose state goals carefully. Employment-based initiatives require a different

strategy than science and technology-based programs.

- o Leverage state resources by examining the confluence of federal program funds, industry supported, and university strengths.

  There are a number of options open to states which require only limited capital expenditure — a rare and wonderful occurrence. For example:

  - — Establish formula matching grants with the private sector, on a competitive basis, to infant industries.

  - — Offer incubator space in state surplus facilities.

- o Recognize that the retention and retraining of skilled professionals is a key concern for firms in isolated areas. Therefore, states might institute and offer audio, video, or telecommunication courses in engineering, etc. via the state universities to remote locations.

- o Recognize that the time line for results is most often longer than any one term in office.

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